

# The Integration of Crops and Water Resources in Punjab

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**Abstract:** *In spite of the fact that it contains just 1.5% of the total land area of the nation, the state of Punjab has seen tremendous expansion in the agricultural sector, notably in the production of food crops. Agriculture in the state is given a boost thanks to the green revolution. Because of the region's high rate of agricultural production, Punjab is often referred to as the "breadbasket" of the nation. The natural resources are being utilised to their maximum capacity in order to maintain the current level of agricultural development in mono-crops (rice and wheat). The Indian state of Punjab is now struggling with an issue related to the depletion of ground water. The adoption of more contemporary agricultural methods has raised significant concerns over the viability of continuing to rely on groundwater for agricultural purposes. It is essential that some land be converted to other crops that are acceptable to consumers via the use of market incentives, particularly in regions where rice output is poor. In order to make efficient use of available water supplies, one of the primary goals should be to spread awareness about drip irrigation and sprinkler systems.*

**Keywords:** Agriculture, Groundwater

## I. INTRODUCTION

The word "Punjab" means water. It combines the meanings of two Persian words: āb (water) and panj (five). The Punjabi name, which means "The Land of Five Waters," alludes to the Jhelum, Chenab, Ravi, Sutlej, and Beas rivers. The state's dominance over other water resources is shown by the name Punjab. However, the state of Punjab is now dealing with a groundwater depletion issue. The continued use of ground water for agriculture is very questionable given current agricultural methods.

The state of Punjab, which comprises only 1.5% of the nation's total land area, has seen notable development in the agricultural sector. The State's output of food crops, namely rice and wheat, has increased dramatically. The nation's food crisis is resolved and poverty has been eradicated thanks to the large yields of wheat and rice. Although Punjab's agriculture has made significant progress, over use of natural resources—especially groundwater resources—has resulted from this progress. The green revolution has resulted in a change from traditional diverse crops to monocultures of rice and wheat because to reasons including scientific improvement, highbred diversity of seeds, pricing policy, market infrastructure, and cheap cost of irrigation. However, excessive use is being made of natural resources in order to maintain the current rate of development in monocrops (rice and wheat). A grave scenario and several associated issues are being created by the growing doubts about the sustainability of the current agriculture systems. because the rapid drop in the water table makes it seem that the area planted to rice and wheat cannot continue at this rate. It will pose a risk for further environmental and health problems. In addition to the unequal use of farm resources and related social issues, the state's intense agricultural production has resulted in environmental degradation such as a decline in the water table, deterioration in soil health, persistence of pest problems, and erosion of biodiversity (Singh et al., 1997).

### 1.1 Study Subject

The state of Punjab is situated geographically in northwest India. It stretches between longitudes of 73.55° East to longitudes of 76.50° East, and from latitudes of 29.30° North to 32.32° North. 50,362 square kilometers (19,445 square

miles) make up its total area. Its international borders are shared by Pakistan on the west, the states of Jammu and Kashmir on the north, the state of Himachal Pradesh on the east, and Haryana and Rajasthan on the south.

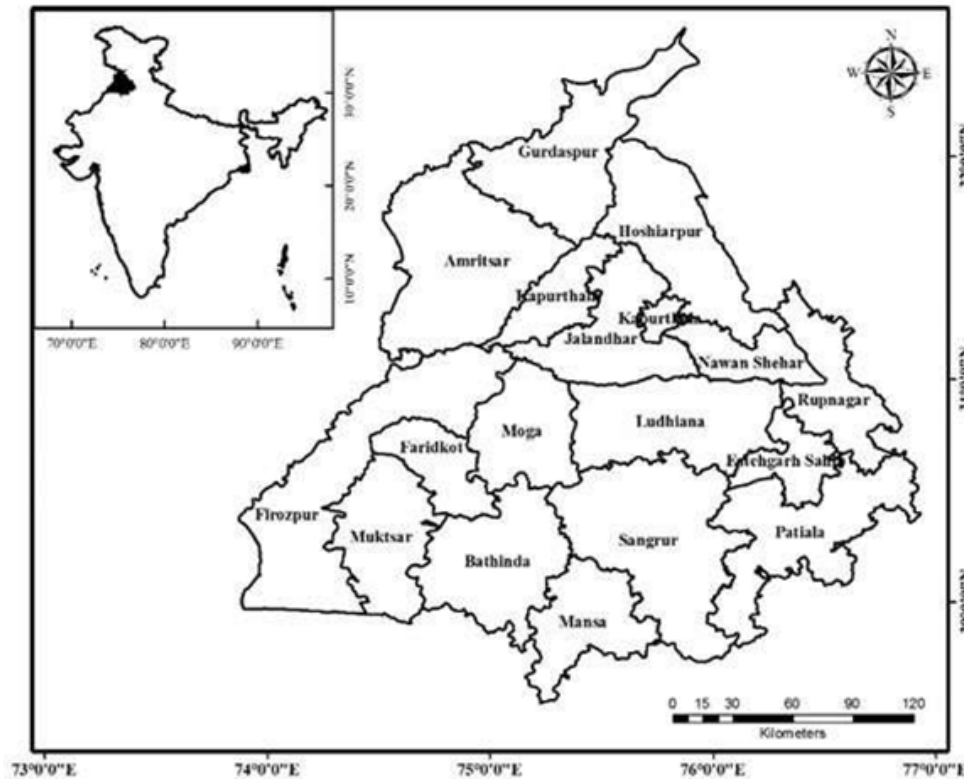


Fig. The present study seeks to understand the following objectives;

### 1.2 Objectives of the Study

- To comprehend the connection between Punjabi agriculture and the green revolution.
- To comprehend the connection between excessive groundwater usage and agriculture.

### 1.3 Database and Methodology

The secondary sources of data are employed for the suggested investigation. A variety of secondary data, including information on land use, cropping patterns, average yields of various crops in the state, area irrigated by various sources, etc., are utilized to provide context and facts for the study of monocropping and the related ground water issue. A few previously conducted research on this topic were also analyzed in order to corroborate the facts and data. The primary sources of data for the research were Punjab Agricultural University and the Department of Agriculture. A range of statistical diagrams are used to illustrate the data.

## II. RESULT AND DISCUSSION

**Green revolution and agriculture in Punjab:** In India, the initial phase of the green revolution began in the late 1960s. One of the main states that profited from the green revolution was Punjab. The state's agriculture was revolutionized by the green revolution and associated technologies, making it the "breadbasket" of the nation. The availability and distribution of high-yield seed varieties, increased irrigation through extensive tube well development and groundwater utilization, maximum utilization of available fertilizers, favorable government policies such as electricity subsidies, and market incentives such as high Minimum Support Price for wheat and rice crops are the main reasons for the increased production of food crops. Punjab's wheat and rice output has increased thanks to the green revolution. According to statistical summary statistics from Punjab in 2013, Punjab had the highest average paddy production in India, at 4716 kg/ha.

**TABLE-1 PUNJAB: PRODUCTION OF MAJOR CROPS**

Major Crops(Production in lakh MT)				
Years	Rice	Wheat	Cotton	Sugarcane
1960-61	2.5	15.43	4.92	1.46
1970-71	4.29	25.34	3.45	1.41
1980-81	13.04	30.99	7.15	0.78
2000-01	28.79	37.56	5.22	1.33
2012-13	31.36	38.82	5.3	0.91

**Department of Agriculture, Punjab, 2013**

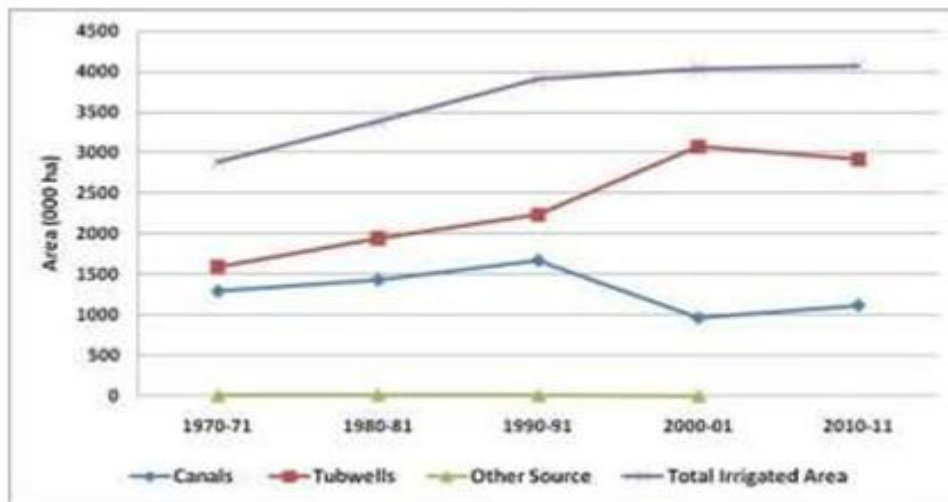
Table 1 makes clear that the output of food crops, particularly wheat and rice, increases after the 1960s, when Punjab saw the green revolution. Crop variety has now given way to the monoculture of food crops, namely rice and wheat. The production of wheat and rice increased steadily between 1960–1961 and 2012–2013, while the production of cotton declined between 1960–1961 and 1970–1971, then increased again until 1990–1991, at which point it again slowed down to 474 thousand MT and 481 thousand MT in the years 2000–2001 and 2012–2013, respectively. Similarly, sugarcane output fell precipitously between 1960–1961 and 2012–2013, with only modest increases between 1990–1991 and 2000–2001. Due to India's economy being more liberalized, the years 1990–1991 are seen as a time of growth.

**Agriculture and Exploitation of Ground Water:**

Of the state's overall geographical area of 5 million hectares, the net area planted makes up around 4.2 million hectares. Unproductive ground was recovered and fallow land was turned into cultivable land. Punjab State tops all of India in net irrigated land (percentage), and the state utilizes roughly 85% of its water for agriculture. The cropping intensity also rose, rising from 126 to 190 percent. The increasing amount of land used for agriculture has resulted in an even larger requirement for water resources. Therefore, the choice of crops with greater water needs has superseded the exploitation of the natural resource water, especially ground water. Growing acreage under cultivation, increasing cropping intensity, and shifting crop patterns have resulted in a roughly 170 percent increase in the quantity of water required over the last 50 years. Estimates indicate that the state's yearly supply of irrigation water from canals and ground-water resources is 3.48 million hectare meters (mhm), whereas the state's total annual demand is 4.76 million mhm. Because of this high demand, there is an annual net shortfall of 1.28 mhm (Jain, A K), which is made up for by overusing groundwater resources via tubewells. Water from tubewells, whose number has almost increased in the last 20 years, currently supplies 84 percent of the irrigated area.

**Punjab: Net irrigated area by various sources**

Figure illustrates that Punjabi farmers prioritize tubewells above other irrigation methods. The number of tubewells suddenly increased starting in 1990–1991 years. The overuse of groundwater is closely related to the need for a greater number of tubewells. Evidence suggests that ground water extraction rose in tandem with the state's tubewell count. Water overuse is further supported by the fact that the number of tube-wells increased from 192 thousand in 1970–1971 to 1276 thousand in 2008–2009, despite a decline in canal coverage across the state. The ground water level decreased by up to 0.75 to 1 m/year in certain places. In many areas, overexploitation has caused the groundwater table to drop below the 10-meter barrier. From 1982 to 1987, the water table fell at a rate of 18 cm. From 1997 to 2002 (Hira et al., 2004), it climbed to 42 cm, and from 2002 to 2006 (Singh, 2006), it fell to 75 cm. Compared to the availability of 21.44 billion m<sup>3</sup>, Punjab extracts 31.16 billion m<sup>3</sup> of ground water annually.



**TABLE-2: DISTRIBUTION OF BLOCKS IN DIFFERENT CATEGORIES ON BASIS OF UNDER GROUND WATER RESOURCES IN PUNJAB**

S. No.	Category	2000	2005	2010
1	Safe	27.54	18.25	16.67
2	Semi-critical	11.59	2.92	1.45
3	Critical	7.97	3.65	2.17
4	Over-exploited	52.9	75.18	79.71
	Total	100.00	100.00	100.00

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110 of the 138 blocks in the state had overexploitation in 2010—that is, overexploitation equal to 100% of the net yearly recharge of water. Three blocks were classified as semi-critical (exploitation between 65 and 85%), whereas two blocks were classified as critical (exploitation over 85%). As a result, only 23 blocks were considered secure. Stated differently, 80% of the state's total geographic area has experienced overexploitation of groundwater, with an additional 4% falling into the critical or semi-critical category.

**III. CONCLUSION**

Punjab's natural resources are being quickly depleted in order to sustain the present level of agricultural growth. The vast amount of land used for rice cultivation, along with the present intense production technique, is the main source of ground water depletion and sustainability issues. For this reason, it is essential to transition from monocultures of wheat and rice to alternative crop rotations in order to save soil and water. Prioritizing water resource conservation and judicious usage is important. Special attention should be paid to the declining water tables in the state's core areas.

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